source of gravity, and other central forces; and it is not impossible but that the relations of this medium to the particles of common matter may admit of considerable modification or change, and which may be the source of that peculiar power we find displayed in those bodies we consider as being magnetic and call magnets. It has been occasionally supposed that in the reciprocal force between magnets and iron there is a peculiar agency in operation, the law of which is disturbed by the new forces of induction liable to ensue in changing the distances. The author however is of opinion that such a notion is inconsistent with the course of nature; it is induction which constitutes magnetic action, there is no other form of action; when induction is not present there is in fact no action; we must hence look to these very changes for an explanation of variable magnetic force.

10. "Researches into the Identity of the Existences or Forces, Light, Heat, Electricity and Magnetism." By John Goodman, M.D. Communicated by Thomas Bell, Esq., Sec. R.S. &c. Received March 7, 1851.

In this communication the author describes the effects that were produced on a moderately sensitive galvanometer by exposure to the sun's rays, and which were observed by him during a period of four months, commencing on the 14th of November, 1850. The instrument is described as consisting of forty-six turns of covered copper wire, $\frac{1}{25}$th of an inch in diameter. The helix is blackened with ink at its southern extremity, and has a single magnetized sewing-needle suspended by about sixteen inches of silken fibre in its centre. The dial, which is of card-board, and divided into the usual number of degrees, rests upon the upper surface of the helix, and shades it from the ordinary light or sun's rays, except at its extremities, and occasionally some portions of the lower bundle of wires; and when the sun is very low the rays may be seen also to illumine to some extent the surface of the upper bundle. The indicator is formed of a slender filament of light wood in the usual manner, and the whole is enclosed in a glass shade. This instrument was placed for experiment in a window having a southern aspect; and whilst the sun was strongly shining upon it, it was frequently observed that there could not be obtained, either on account of vibrations or the erroneous condition of the instrument, any true indications. On shading the instrument from the sun's rays by a screen, the vibrations ceased, and the needle again adjusted itself north and south.

On removing the screen the needle began again to vibrate, and was soon discovered to become stationary at some distance from zero, indicating the transmission of a current in the helix. This deflection of the needle was soon found to be always, under the same circumstances, in the same direction, and to give indications of a current corresponding to the brightness of the sun.

This action appeared to depend upon the incidence of the sun's rays upon the south extremity, and some of the lower or upper bundle of wires only of the helix; for when they began to illumine

the opposite extremity, either very slight indications, or a neutral result, constant vibrations, or the movement of the needle some degrees in the opposite direction, were always observed. The maximum deflection, at any time attainable by the galvanometer, when the sun was quite unclouded, was about 12°, generally only 10°. It may be observed that in all these experiments the power of the rays was probably somewhat diminished, by passing though the glass pane of the window, and through the glass shade of the instrument itself.

In order to show that the effect was not thermo-electric action, the extremities of the helix were removed from their mercury cups and wrapped in paper, so as to exclude the mercurialized portion of the copper from the action of the sun's rays; but no alteration occurred in the ordinary results of the experiments. There is, moreover, the author considers, no evidence on record of any thermo-electric action ensuing from the application of heat to copper wire alone, nor without the formation of a complete electrical circuit. But in these experiments hitherto the completion of the circuit had not been attempted. During the course of the experiments the circuit was established by means of a connecting wire between the mercury cups, and the circuit was again and again completed, and as frequently broken, without any deviation occurring in any of the results, either during the progression, stationary condition, or decline of the needle.

That these phenomena were the result of the action of the sun's rays upon the helix itself, was further shown, from the circumstance that when the sun remained clouded for days together, there was no deflection of the needle; that when the helix was partly shaded by a pillar, or the window-frame, the instrument indicated an amount of current corresponding to the number of coils of wire illumined; and *that the illumination of the whole bundle of wires* at the southern extremity of the helix was necessary to produce the usual results, for when a burning lens of high power was employed to condense the rays and throw them in a focus upon one or two wires only, no deflection of the needle was observed. It was also further shown that the action of the rays upon the helix was attributable to that portion situate chiefly at the southern extremity, for the whole instrument was in a variety of ways and at different periods shaded from the solar rays; but its results were unaffected, unless the south end was obscured, when the needle immediately declined; or the north end was illumined when the deflections were lessened, or the motion of the needle took place in the opposite direction.

A pile of red-hot burning embers held in the vicinity of one extremity of the helix caused a slight deflection of $\frac{1}{2}$°, and when held at the opposite extremity, caused a deflection in the opposite direction.

The author states a remarkable circumstance, viz. that vibrations and neutral action were observed during bright sunshine about the 11th of December, and again on the 23rd of January; that previous to the former period the deflections of the needle were to the *left-hand*; between these two periods they were to the *right-hand*; and

after the latter period always to the left, after a given hour of day During the early sun, however, they were to the *right-hand*, and as the sun approached a given altitude, they were invariably to the *left-hand*. Deflections observed during the summer season were also to the *left-hand*; but those of the early sun were not submitted to the test.

On testing the instrument with a voltaic pair, it was shown that the current passed from south to north *above the needle* with the *early sun*, or when the indicator deflected to the right-hand, and *beneath the needle* with the rays which proceeded from a *considerable elevation*, or when the needle deflected to the left-hand.

In conclusion, the author states that the results of these experiments evince to his mind more than ever the *unity of force*; and that experimental evidence appears to justify the conclusion at which he has long since arrived, *that there is one, only, universal force in nature, which is modified by the accidental and varied conditions to which it is subjected, but that its essential nature and characteristics are at all times unchangeably the same.*

11. "On the Mean Temperature of the Observatory at Highfield House, near Nottingham, from the year 1810 to 1850." By Edward Joseph Lowe, Esq., F.R.A.S. Communicated by Marshall Hall, M.D., F.R.S. Received May 3, 1851.

The object of the author in this communication is to connect the series of thermometrical observations made by the late Matthew Needham, Esq., at Lenton House, at the distance of only 200 yards from the observatory of Highfield House, with those made by himself from 1842 to the present time at the latter place. He procured Mr. Needham's observations from the Committee of the Bromley House Library, Nottingham, and also the instrument with which they were made, and which, upon comparison with his own standard, was found by Mr. Glaisher to be correct.

Mr. Needham's observations were registered at 8 A.M. and 11 P.M., and to the monthly means of these records corrections have been applied to convert them into mean monthly values. Those made by the author were registered at 9 A.M. and 9 P.M., and these, together with the highest and lowest readings of self-registering thermometers, have been subjected to the same process.

The following tables deduced from the observations are given in the paper:—

1. The mean temperature of each month at Highfield House from 1810 to 1850.

From this table are deduced the mean temperature of each month from all the observations, viz.

January 36°·2; February 38°·9; March 42°·4; April 47°·6; May 53°·6; June 58°·7; July 61°·1; August 60°·2; September 56°·6; October 50°·0; November 42°·9; December 39°·1.

2. The highest and lowest monthly mean temperature in every year, from 1810 to 1850, with the amount of difference of temperature.